The End of Abundance: Water Infrastructure and the Culture of Cornucopianism

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We are living in a profoundly disorienting and disquieting historical moment. Populist authoritarianism is on the rise around the globe. We have seen leaders of supposedly liberal states attack the press and flout norms that have been mainstays of politics for generations—actively attempting to undermine trust in the very institutions it is their duty to preserve. We have seen children put into cages. We have seen white supremacists terrorize communities. All the while, these leaders cajole their xenophobic, misogynistic, and racist followers to intimidate and murder vulnerable populations. A surge in nationalism has seen leaders refuse aid to immigrants, use their armies to invade and occupy neighboring regions, and dissolve longstanding agreements. The gulf between the wealthiest and the poorest is growing ever wider, sustained by the political assault on unions, the expansion of corporate power, and the disintegration of regulatory frameworks. The veil of liberalism is disintegrating, exposing the deep structural inequities and latent hatreds that define late capitalism.

All this is set against the background of a rapidly changing climate, which promises to further destabilize societies across the globe. The most optimistic forecasts—those that assume massive, global cooperation to rapidly decrease carbon emissions—promise widespread disruptions of the planet's ecosystems. We have already begun to experience the first effects of these changes: unpredictable weather patterns, drought, high-intensity storms, sea level rise, and the acidification of oceans.

In the best case scenario—one that assumes governments across the globe will enact the Paris Agreement developed at the 2015 United Nations Climate Change Conference (COP 21)—humans across the globe will be forced to live through unprecedented environmental upheavals and their unpredictable societal consequences. Unfortunately, though, key signatories (most notably the United States), have abandoned their obligations, in part, at the hands of populist leaders who deny the realities of anthropogenic climate change. The best case scenario is unlikely to be the one we live through.

Since 2017, the government of the United States has supported the expansion of coal and oil extraction and forced the EPA to allow increased greenhouse emissions from coal plants. It has attempted to roll back emissions standards and taken aim at states such as California that have fuel efficiency standards higher than federal requirements. Against this backdrop, the petroleum industry is actually expanding its global production of oil to the tune of an extra 7 million barrels of oil per day. Rather than pulling back on greenhouse gas production, we are increasing it.

Even more worrying, evidence suggests that global warming is initiating feedback loops. In recent weeks, for example, scientists found a massive "methane fountain" in the East Siberian Sea that seems to be tied to melting permafrost. As a greenhouse gas, methane is over eighty times more powerful than carbon dioxide at retaining heat. Consequently, it has the potential to escalate the rate of global warming, releasing even more methane stored in the earth's permafrost.

This is the author's version of the work published in final form as:

Kelly, J. M. (2019). The End of Abundance: Water Infrastructure and the Culture of Cornucopianism. *Dilettante Army*. http://www.dilettantearmy.com/articles/the-end-of-abundance

Without a doubt, we are entering a self-created global crisis that is likely to affect generations for centuries, if not millennia.

Among the most pressing global environmental concerns associated with climate change is the distribution of and access to global freshwater. While popular imagery often imagines Earth as a "blue marble"—a planet covered in abundant water that makes life possible—the reality is quite a bit different.

If we were to take all of the water on the planet, it would fit inside a sphere with a diameter of only 860 miles, roughly the distance from New York City to Birmingham, Alabama. Of this water, only about 2.8% of it is freshwater—a sphere with a diameter of about 170 miles, the distance between New York and Baltimore. Most of this water is in groundwater, ice, snow, and glaciers. Only 1.2% of it is in rivers and lakes, the atmosphere, and living beings. This means that while it appears that water is all around us, very little freshwater is easily accessible. We have limited quantities to share with the many other living creatures with whom we share the planet—the trees and other plants, the fungi, the insects, the birds and other animals with which we live in delicate balance.

Changing climate is noticeably affecting the planet's limited reserves of freshwater. Melting glaciers and decreased snowfall threaten the steady supply of freshwater to a billion people in Asia alone. In cities such as Cape Town, droughts compounded by human extraction have threatened to bring cities to so-called "Day Zeros"—the moment at which reservoirs run empty, municipal water is turned off, and citizens have to queue for rationed water. In fact, in early 2019, Chennai—a city of over seven million people—turned off its taps. Its four reservoirs had run dry. The city's citizens are currently relying on government and private water tankers to deliver water.

Unsurprisingly, we humans are using far more than our fair share of freshwater. While humans make up about one ten-thousandth (1/10000) of all the biomass on the planet, we consume between 25% and 50% of all the annual precipitation for our domestic, agricultural, and industrial uses. About 70% of this goes to the agricultural sector. It takes about 1500 liters of water to produce one kilogram of grain. One kilogram of beef, on the other hand, takes 15,000 liters. It seems obvious that given the demand for water, we should be decreasing our consumption of animal proteins—not to mention the fact that livestock cultivation increases pollution, fertilizers, hormones, and pesticides in the water cycle and that the resulting system of monoculture threatens biodiversity through habitat loss. Instead, humans are doing the opposite. The demand for more animal protein around the globe has doubled since 1970 and will likely increase by another 70% over the next thirty years.

Water quantity is only one half of the water supply equation; water quality is the second half. Even as regular water supplies are disrupted by climate change, and even as humans extract more and more water to feed industry and agriculture, we are pouring pollutants into the water system. In cities with poor sewer infrastructure, these pollutants might be a combination of human and industrial waste. In 2018, for example, residents around Bellandur Lake in Bengaluru were confronted with walls of toxic froth that poured from the water. The lake is so polluted that the city has dealt with a series of fires on its surface water over the past several years.

In many regions of the world, the pollution of water systems is often the result of global consumption. Rich nations in particular are responsible for offloading environmentally unsound industrial practices on poorer countries in the name of development. Fast fashion—the system of creating cheaply made, disposable clothing to supply retailers—is notorious for polluting water. In Vietnam, for example, industrial textile and dye industries have been key contributors to river pollution. With the pollution of surface water, inhabitants have been forced to bore wells, resulting in the extraction of ever-increasing amounts of freshwater from local aquifers. This has resulted in a substantial drop in the water table. Sea level rise and the depletion of fresh groundwater have led to "saline intrusion"—the incursion of saltwater into underground water supplies.

As water supply becomes precarious in more and more places around the globe, the environmental context is coming head-to-head with socio-political realities. Across the globe, 263 river basins are shared across national borders. These basins provide water to 40% of world's population. "Upstream states" have the capacity to place even more pressures on "downstream states." In other words, transnational security is linked to our management of water. In Southeast Asia, for example, China is currently constructing a series of dams along the Mekong River that will control the flow of both water and hydroelectric energy to countries including Myanmar, Laos, Thailand, Cambodia and Vietnam. This positions them in a powerful political position vis-à-vis their southern neighbors. In Southern Sudan, water scarcity is directly linked to increased child kidnappings and sexual assaults.

If the political instabilities of the current moment are troubling now, the environmental crises of the next decades will only become more so. At the center of these crises will be struggles over water.

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Living in the United States, with its relatively intact infrastructure, along with the distractions of mass consumption and mass entertainment, it's sometimes easy to forget that the same environmental pressures that threaten places such as Chennai and Ho Chi Minh City are those that we are currently (or will soon be) dealing with in our own cities and towns. That is, unless an extreme event shakes the foundations of our consumerist reveries—drought and wildfires in Southern California, lead in Flint's drinking water, hurricanes and storm surges on the eastern and southern coasts.

And, when challenges do come our way, it's easy to fall back on well-ingrained assumptions about how to respond. We tend to treat disasters as exceptions to the norm—even as they seem to become more regular and more dangerous. And, when planning for the future, we tend to assume that we can engineer ourselves out of any challenges that we face. Rather than dealing with the underlying causes of environmental pressures, we try to design systems that will maintain a semblance of the status quo.

In part, this is due to the ways in which we imagine past engineering successes. In the wake of floods such as the Great Mississippi Flood of 1927 and the Ohio River Flood of 1937, the Army Corps of Engineers constructed a series of levees, dams, flood walls, and embankments to manage water flows. In the American West, speculators, politicians, and engineers turned the Colorado River into a hydrological machine that provides for the needs of millions of citizens as well as the agricultural and industrial infrastructure that provides them employment. Across the country, the creation of reservoirs, sewage plants, and water treatment facilities has helped manage disease and provide Americans with a seemingly limitless supply of low cost freshwater.

Both the economic and the environmental costs of these developments are rarely considered. Most Americans turn on the tap or flush the toilet without reflection. We eat water-intensive foods such as avocados and almonds and beef from drought-prone regions of the United States. We have faith that we live in a land of cornucopian abundance—one in which our desires can always be satiated.

The problem with this outlook is that these desires have always come with unintended consequences. The expansion of Mississippi levees have actually resulted in more severe floods over the past 150 years—many of which have had an inordinately negative affect on African American populations. The extraction of water from the Colorado River decimated one of the most vibrant river deltas in North America—a place that Aldo Leopold once called "a milk-and-honey wilderness." Even the introduction of clean water to homes has come with a price. Maintaining these systems is expensive, and cities are sometimes reluctant to deal with issues emerging from them. In worst-case scenarios, as with Flint, MI and Newark, NJ, negligence has led to years of dangerous levels of lead contamination in water systems that in both cases primarily affect African American communities.

The tendency within the United States to engineer systems that feed a cornucopian consumerism has left communities across the country in a precarious position when it comes to water systems. On the one hand, citizens and politicians treat water as a low-cost, inexhaustible commodity. On the other hand, they generally imagine that any challenges or crises they face are temporary and can be solved through some combination of increased extraction and engineering ingenuity. Of course, given the radical transformation of the climate system, this way of imagining the world is unsustainable and must be addressed at all levels—in our education system, in our political dialogue, in our civic discourse.

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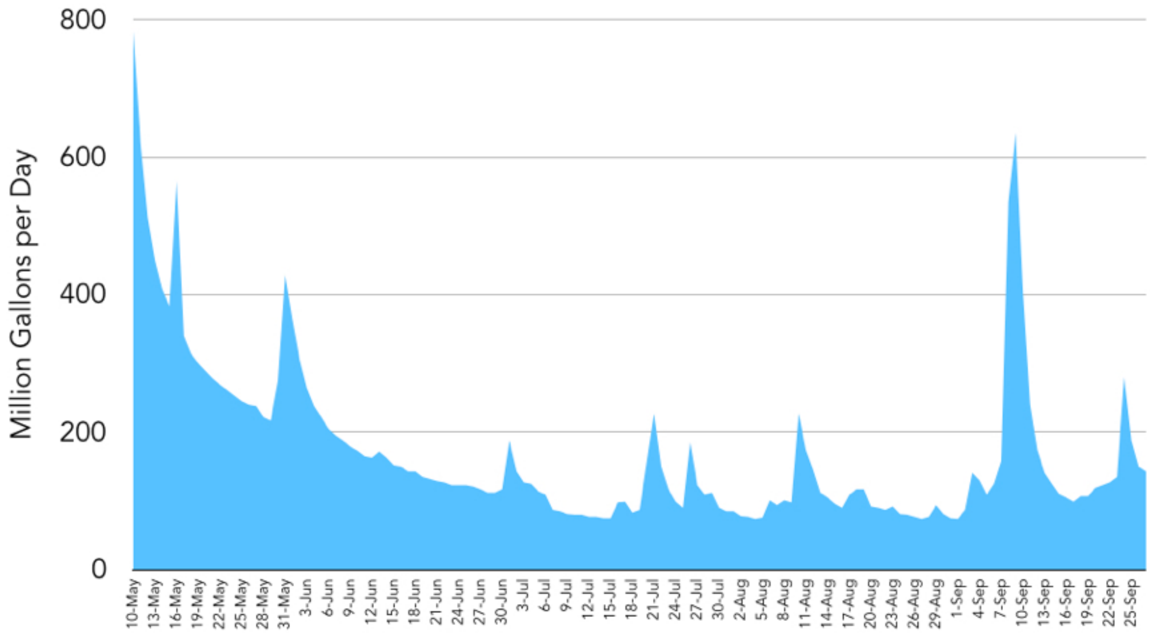
As this essay has done so far, much environmental conversation about water tends to drift towards dire prognostications and prototypical examples such as Flint and Chennai. These conversations can take us only so far. They can demonstrate the gravity of the topic. They can help us frame problems in broad terms. They can help us see global connections and common conundrums. But, most decisions about water infrastructure are made at the local level. Discussions take place in drab boardrooms and city council meetings. So, to participate in shaping their environmental futures, it is essential for people to understand what is happening in their own backyards.

My backyard is Indianapolis. Indianapolis is a sprawling metropolitan area in central Indiana with a population of about two million. The local water utility provides the water for much of this population. The supply comes from a variety of sources: the White River, which flows through the center of the city; the Central Canal, a waterway meant to connect the Wabash and Erie Canals to the Ohio River (the construction of which was abandoned in the wake of the Panic of 1837); as well as three major reservoirs, Morse Reservoir, Geist Reservoir, and Eagle Creek Reservoir.

In 2012-13 Indiana experienced one of its worst droughts on record, part of a larger drought that affected much of the United States. By the middle of July 2012, over 80% of the contiguous United States was in drought conditions. The economic costs were astounding—approximately $40 billion in agricultural losses alone.

Leaves shriveled on the trees. Corn turned brown in the fields. Streams that had flowed steadily earlier in the spring began to dry up. Streamflow data that registered hundreds of millions of gallons per day earlier in the year showed rivers slowing to relative trickles. Now and again the flow of the White River would spike with short-lasting rainfall, but it did little to alleviate the drought.



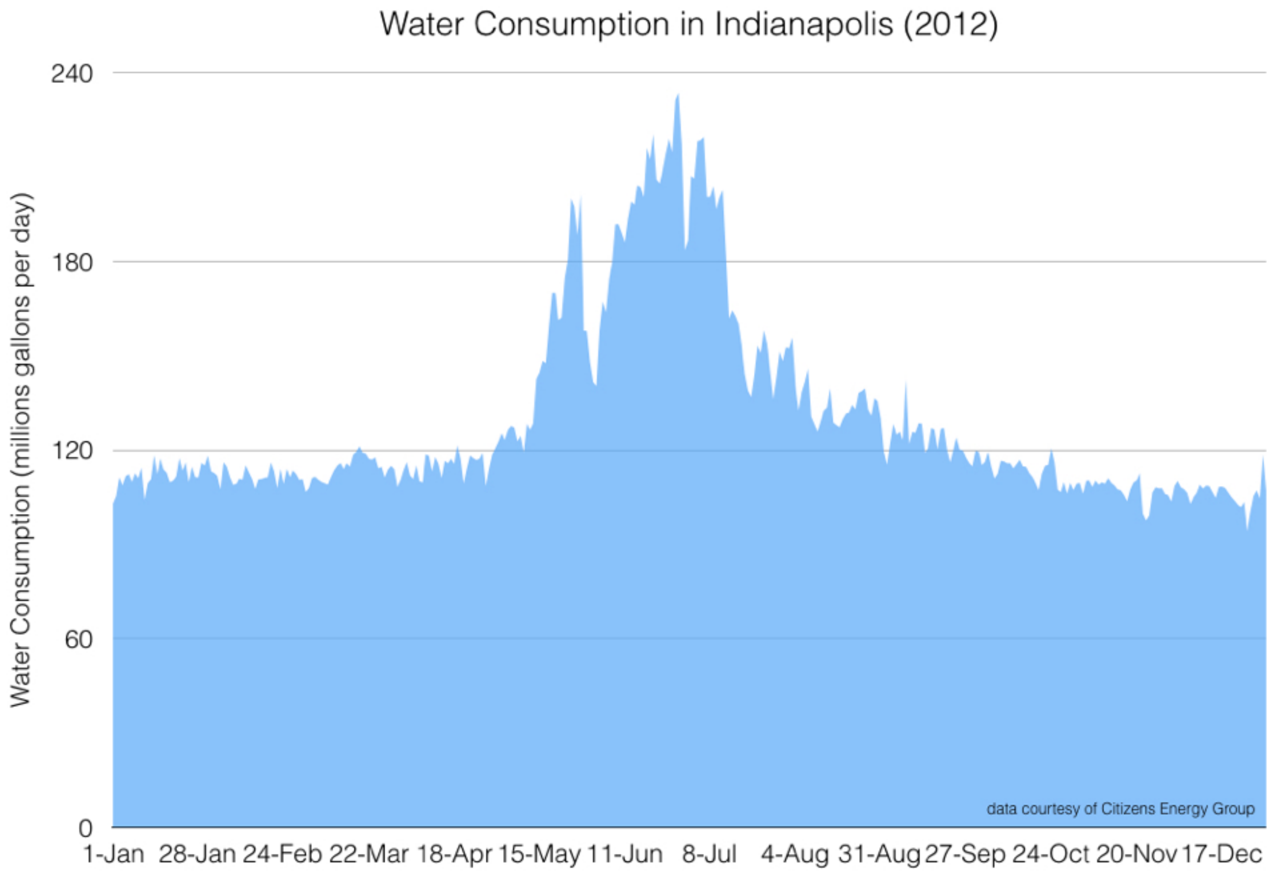
Flow of White River Water in Noblesville, IN. Data courtesy of USGS.

Even as the region's rock-solid clay soils began to crack, water consumption increased. According to data from the local water utility, consumers began the summer by withdrawing about 100 million gallons per day. By the height of the drought, this number had more than doubled. They were using nearly 230 million gallons of water per day.

In early July, residents were pulling eighty-four million gallons per day from Morse Reservoir and forty-two million gallons per day from Geist Reservoir. Already 4½ feet below normal, Morse Reservoir was dropping a foot every 5 days. Boats were stranded aground. Formerly floating docks hung suspended between piers. Grass sprouted from the lake bed.

Still, across the city, lawns stayed green. In the suburbs, evening walks were accompanied by the ever-present shthk-shthk-shthk-tk-tk-tk-tk-tk of lawn sprinklers.

Water consumption peaked in Indianapolis in early July, only to drop off precipitously after July 11. The drought hadn't ended—rather, the Indianapolis Mayor's Office banned lawn irrigation. Over the following month, joined by other municipalities, water consumption dropped down to near-average levels. The lawns turned brown. Nearly all of the increased water use had been due to lawn irrigation.



Water Consumption in Indianapolis (2012). Data courtesy of Citizens Energy.

While the drought was happening, leaders in Indianapolis were in the middle of a debate over the future of the city's water infrastructure. Developers, business groups, and government officials alike worried that the city's reservoirs would not be enough to keep up with increased use over the next two decades. In fact, the Indiana Chamber of Commerce commissioned a report that projected that water consumption would increase by fifty million gallons per day. In the wake of the 2012-13 drought, it seemed clear to some that building another reservoir would increase water capacity to meet peak demand.

Upstream, the Anderson Corporation for Economic Development was hatching an idea. The small city of Anderson could create a reservoir and sell the water downstream to Indianapolis. The reservoir would increase property values (except for 400 or so displaced families) and increase tourism, they argued. They would name it Mounds Lake.

The name, Mounds Lake, came from an important historical site that would butt up against Mounds State Park. Home to ten earthworks created by the Adena and Hopewell peoples between 150 BCE to 50 CE, the park protects these works—important survivors of two ancient indigenous societies in North America. The lake, projected to come within sixty feet of these earthworks, had the potential to threaten their structural integrity.

The 2012 drought was powerful ammunition for proponents of new engineering projects. They were asking important questions: how to guarantee an infrastructure that could meet peak demand, provide for a growing population, and get a city through an extended drought.

The problem is—as it so often is—that the answers to those questions were going to fall within the logics of consumer cornucopianism and techno-utopianism. No matter how much low-cost water people wanted, it would be available so long as we designed bigger and better systems to extract it from the environment. The executive summary of the Indiana Chamber of Commerce's study put it in no uncertain terms: "We have built an economy that expects water when it needs it." The questions were not about the ethics of water extraction and consumption. The questions were about the economics of making it work—how to get enough water to meet peak demand.

What is peak demand though? Taking lawn irrigation out of the equation over the summer of 2012 dropped water consumption from 230 million gallons a day to about 100 million gallons per day. Was it reasonable to build a water infrastructure so that people could maintain green lawns? After all, the desire for a green lawn is an aesthetic preference—one that is the consequence of historical cultural developments.

In the 18th century, wealth, power, and gentility in Western Europe and the US became associated with green lawns. In the segregated suburbs of the middle of the 20th century, the properly manicured green lawn was central to the performance of a white, middle class respectability. Abraham Levitt, founder of Levitt & Sons, the developer of the segregated Levittowns of the East Coast, summarized this suburban ideal, "No single feature of a suburban residential community contributes as much to the charm and beauty of the individual home and the locality as well-kept lawns."[1] Green lawns remain a symbol of privilege, status, and respectability—the guidelines for which are written into the covenants of thousands of subdivisions across the country.

What the lesson of 2012 might have taught the Indianapolis is that its concerns about water supply were as much (if not more) a cultural problem as an engineering problem. It might have encouraged the city to look out for other cultural practices that increased water use—long showers, ignoring leaking taps or running toilets, or planting non-native species that require increased irrigation. Policies that promoted water conservation, harvesting, and re-use might have saved residents the cost of building out new infrastructure. Instead, Indianapolis is building a new reservoir on the northeast side of the city that can hold up to 3½ billion gallons of water at an expected cost of $30 million.

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The example of water consumption in Indianapolis during the 2012-13 drought is an example in miniature that exemplifies the conundrums that people across the globe will face as climate change advances. In many cases, communities won't be met with immediate crises. Instead, they will have to plan, making relatively small decisions in their attempts to mitigate or respond to potential environmental problems. They will be at a disadvantage if their fallback position is to use technology and engineering to help them maintain their current levels of consumption—if they attempt to solve environmental problems without understanding how these problems are deeply rooted in sociocultural systems.

Our disorienting and disquieting historical moment is a moment of our own making—unprecedented in the history of humankind. It's a moment that requires action, but it's also a moment that requires us to think seriously about *why* we are taking specific actions. What are the frameworks that determine both the questions we ask and the answers that we find? Recognizing that geobiophysical systems are entangled with sociocultural systems will be a key step in creating sustainable and practical solutions to environmental change. Not only do sociocultural systems drive the processes that create this change, but they also help shape how we think about and respond to it.

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[1] Quoted in David Kushner, *Levittown: Two Families, One Tycoon, and the Fight for Civil Rights in America's Legendary Suburb* (New York: Walker & Company, 2009), 153.